

REMARKS:

Claims 1-3 are in the case and presented for consideration.

The Examiner has rejected claims 1-3 under 35 U.S.C. § 112, second paragraph. Claim 1 has been amended to correct the term "and/or" to be definite so that claims 1-3 are now believed to be in proper form.

Claims 1-3 have also been rejected as being anticipated or obvious under 35 U.S.C. § 102(b) or 103(a) from U.S. Patent 5,276,250 to Hagenmaier.

According to claim 1, the subject matter of the present application is a method for dehalogenation detoxification of halogenated aromatic and/or cyclic compounds wherein the compound is heated on a support matrix in a closed system at a temperature of 200 to 500°C in the presence of copper in metallic form and in the form of copper compounds, a hydrogen donor, carbon and at least one additional reducing substance, capable of reducing cupric and cuprous ions to elemental copper at the above temperature.

According to the second complete paragraph of page 5 of the specification,

"The use of at least one additional reducing substance in addition to carbon, which is capable of reducing cuprous and cupric ions to elemental copper at the temperature of the dehalogenation process, constitutes the substance of the invention as, in this case, the reversible process $\text{Cu} \rightarrow \text{Cu}^{1+} \rightarrow \text{Cu}^{2+}$ and back occurs, in which the nascent form of copper is formed repeatedly and enables the successful course of the

dehalogenation process according to the invention. The ability of this nascent form of copper to form an intermediate complex of the compound on the aromatic ring is so high that dehalogenation also occurs in positions that are thermodynamically very stable, so that under optimized conditions, a degree of dehalogenation of up to 99,9%, is attained even for highly stable halogenated aromatic and cyclic compounds."

In addition, it follows from the examples of the present application that the claimed dehalogenation method proceeds in the presence of the "addition of reducing substance" or ARS, extremely promptly at relatively low temperatures (in about hours at temperatures less than 300°C). The ARS acts during the claimed dehalogenation process, as a reaction component (it takes part in dehalogenation reaction and allows for a very prompt course of the dehalogenation, contrary to a catalytic dehalogenation processes) rather than a mere catalyst since it changes its valence state during the process.

Hagenmaier at its Example 17, for example, discloses the dehalogenation of halogenated aromatic compounds at 350-500°C in the presence of a mixed CuO/Cr₂O₃ catalyst on a silica support. The material to be detoxified may be fly ash. The Cr₂O₃ has the character of a reducing substance. Metallic copper may be used as well. Cr₂O₃ can not be taken for the ARS, however, because the basic knowledge discovered by the present inventors is that the presence of the ARS in the system of halogenated compound/copper(compound)/hydrogen donor/carbon, extremely shortens the dehalogenation times to several hours which is not the case for the same system

containing Cr_2O_3 . So for example in Example 17 of Hagenmaier, the 99,9% decomposition of HCB is reached at the temperature of 450°C only after 300 hours, compare with 100% dehalogenation of HCB as attained for instance in Example 1 of the present application at the temperature of only 200°C . This is attained after only 4 hours when using citric acid as the ARS. From the foregoing, it follows that Cr_2O_3 behaves during the Hagenmaier process as a classic decomposition catalyst (as is so indicated in relevant examples of the reference) and the process itself is there denominated as the decomposition rather than the dehalogenation. The examples of Hagenmaier are silent on the products to which the starting halogenated compounds are in fact converted which does not exclude the possibility that the decomposition products are still halogenated and that the complete dehalogenation, as reached by the invention, is not in fact the case of for Hagenmaier, not acting as in the invention as an ARS, and thus not converting Cu^{1+} and Cu^{2+} ions into the nascent form of elemental copper in the mentioned system.

Thus, the claimed invention is believed to be novel over Hagenmaier since the latter lacks one of the obligatory process components, i.e. the ARS. This conclusion is also supported by the fact that nowhere in Hagenmaier is it either mentioned or suggested that a reaction mechanism is taking advantage of the nascent form of elemental copper. This is believed to render the claims unobvious over Hagenmaier.

Claims 1-3 have also been rejected under 35 U.S.C. § 102(b) or 103(a) from U.S. Patent 6,303,812 to Fifolt.

The dehalogenation of Fifolt is different from that claimed. The differences are as follows:

- (1) Fifolt concerns a partial dehalogenation whereas complete dehalogenation is

reached by the claimed method of the present application;

(2) Fifolt teaches a dehalogenation temperature of from about 100 to about 200 °C, whereas the present application claims the dehalogenation temperature of 200 to 500 °C;

(3) Fifolt lacks a hydrogen donor which is an obligatory feature of the claimed invention;

(4) Fifolt lacks carbon which is a necessary feature of the claimed invention; and

(5) finally, the dehalogenation of Fifolt is carried out under air atmosphere and no mention that the dehalogenation must proceed in a closed system is given in Fifolt whereas the dehalogenation according to the present application has to be realized in a closed system ensuring a reducing reaction atmosphere (carbon plus oxygen of the closed system → CO). This is only possible for causing the dehalogenation to proceed via the mechanism of nascent form or elemental copper.

Accordingly the claimed invention of the present application is believed to be novel and unobvious over Fifolt.

Claims 1-3 have also been rejected under 35 U.S.C. § 102(b) or 103(a) from U.S. Patent 3,989,806 to Hyatt.

In addition to the fact that the dehalogenation of Hyatt does not include the use of the important ARS which is an essential feature of the dehalogenation of the present invention, the basic difference between the dehalogenation of Hyatt and that of the present application is the first dehalogenation is an oxidation process whereas the second one just proceeds under reducing conditions. Thus, the dehalogenation of Hyatt is very different from that of the present application which renders the subject matter of the claimed invention novel and unobvious over Hyatt.

Claims 1-3 have also been rejected under 35 U.S.C. § 102(b) or 103(a) from European Patent Application EP 1048327 to Saito.

Saito is considerably different from the claimed invention in that the dehalogenation of Saito uses an organosilicon compound having a hydrogen atom directly attached to a silicon atom (this is not included in the dehalogenation of the present application) and it takes advantage of the high reactivity of this hydrogen atom. To the contrary, the dehalogenation process of the present application is based on high reactivity of the nascent form of elemental copper.

From this, further differences derive including the fact that the dehalogenation of Saito does not include the ARS and is not carried out in a closed system, these two features being essential features of the dehalogenation process according to the present application.

Taking into account the foregoing, the subject matter claimed by the present application is believed to be novel and unobvious over Saito.

The Examiner has also rejected claims 1-3 under 35 U.S.C. § 102(b) or 103(a) from U.S. Published Patent App. 2002/0156337 to Jensen.

According to Paragraph 34 of Jensen, the following degradative agents are used: 1) metal couples, as iron/copper or iron/palladium; 2) metal on carbon (Pt/C, Pd/C, Rh/C); 3) ferrous iron; 4) sulfides; 5) and alkaline reagents. If copper is thus used as a degradative agent, this is used in form of an iron/copper couple. But no such use is included in the solution of the claimed invention. In addition, the present application uses copper in combination with a hydrogen donor, carbon and at least one reducing substance, capable of reducing cupric and cuprous ions to elemental copper. But no such

accompanying additives are mentioned in paragraph 34 of Jensen for copper.

The dehalogenation process of the present application is carried out at a temperature of 200 to 500°C rather than at a temperature between 0 and 100°C as in Jensen. The argument that the latter temperature can be routinely elevated to speed up the reaction rate or the degradation process is incorrect. This is so because the catalytic reactions are known to be specifically temperature dependent and so a common rule which states "the higher temperature - the higher reaction performance" does not represent a generally usable guide for those reactions and the person of ordinary skill in the art will use this information.

Finally, the dehalogenation process of the present application uses no stabilizing reagent which, in contrast, is stipulated in Paragraph 34 of Jensen.

Because of the above listed differences between the claimed process using the nascent copper of the present application is quite different from the process of Jensen.

Therefore, it is believed that Jensen does not anticipate the claimed invention under 35 U.S.C. 102, or render it obvious under 35 U.S.C. 103.

Accordingly, in light of the aforementioned, the application and claims are believed to be in condition for allowance, and favorable action is respectfully requested.

No new matter has been added.

If any issues remain, the Examiner is respectfully invited to contact the undersigned at the number below, to advance the application to allowance.

Favorable action is respectfully requested.

Respectfully submitted,
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